now. Mean time you may ſee, that if theſe Experiments do ſucceed, it can no more be ſaid, that all the Colors are neceſſary to compound White, and that 'tis very probable, that all the reſt are nothing but degrees of *Yellow* and *Blew*, more or leſs charged.

Laſtly, touching the Effect of the different Refractions of the Rays in Teleſcopical Glaſſes, 'tis certain, that Experience agrees not with what Mr. *Newton* holds. For to conſider only a picture, which is made by an object-glaſs of 12 feet in a dark room, we ſee, it is too diſtinct and too well defined to be produced by rayes, that ſhould ſtray the 50*th.* part * of the Aperture. So that, (as I believe I have told you heretofore) the difference of the Refrangibility doth not, it may be, alwayes follow the ſame proportion in the great and ſmall inclinations of the Rayes upon the ſurface of the Glaſs.

Compare herewith what Mr. Newton *ſaith in* Numb. 80. *of theſe Tracts*, pag. 3079.

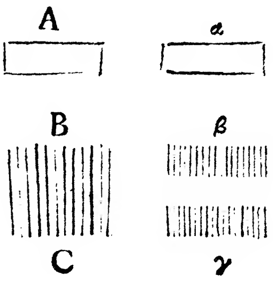
Mr. Newtons *Anſwer to the foregoing Letter further explaining his Theory of Light and Colors, and particularly that of Whiteneſs; together with his continued hopes of perfecting Teleſcopes by Reflections rather than Refractions.*

—Concerning the buſineſs of Colors; in my ſaying that when Monſieur *N.* hath ſhewn how *White* may be produced out of two uncompounded colors, I will tell him, why he can conclude nothing from *that*; my meaning was, that ſuch a White, (were there any ſuch,) would have different properties from the White, which I had reſpect to, when I deſcribed my Theory, that is, from the White of the Sun's immediate light, of the ordinary objects of our ſenſes, and of all white *Phænomena* that have hitherto faln under my obſervation. And thoſe different properties would evince it to be of a different conſtitution: Inſomuch that ſuch a production of white would be ſo far from contradicting, that it would rather illuſtrate and confirm my Theory; becauſe by the difference of that from other whites it would appear, that other Whites are not compounded of only two colours like that. And therefore if Monſieur *N.* would prove any thing, it is requiſite that he do not only produce out of two primitive Colors a white which to the naked eye ſhall appear like other whites, but alſo ſhall agree with them in all other properties.

But to let you underſtand wherein ſuch a white would differ from other whites and why from thence it would follow that other whites are otherwiſe compounded, I ſhall lay down this poſition.

That a compounded color can be reſolved into no more ſimple colors then thoſe of which it is compounded.

This ſeems to be ſelf evident, and I have alſo tryed it ſeveral ways, and particularly by this which follows. Let α repreſent an oblong piece of white-paper about $\frac{1}{2}$ or $\frac{1}{4}$ of an inch broad, and illuminated in a dark room with a mixture of two colours caſt upon it from two Priſms, ſuppoſe a deep blew and ſcarlet, which muſt ſeverally be as uncompounded as they can conveniently be made. Then at a convenient diſtance, ſuppoſe of ſix or eight yards, view it through a clear triangular glaſs or cryſtal Priſm held parallel to the paper, and you ſhall ſee the two colors parted from one another in the faſhion of two images of the paper, as they are repreſented at β and γ, where ſuppoſe β the ſcarlet and γ the blew, without green or any other color between them.



Now from the aforeſaid Poſition I deduce theſe two concluſions. 1. That if there were found out a way to compound white of two ſimple colors only, that white would be again reſolvable into no more than two. 2. That if other whites (as that of the Suns light, *&c.* be reſolvable into more than two ſimple colours (as I find by Experiment that they are) then they muſt be compounded of more than two.

To make this plainer, ſuppoſe that A repreſents a white body illuminated by a direct beam of the Sun tranſmitted through a ſmall hole into a dark room, and α ſuch another body illuminated by a mixture of two ſimple colors, which if poſſible may

may make it alſo appear of a white color exactly,like A. Then at a convenient diſtance view theſe two whites through a Priſm,and A will be changed into a ſeries of all colors, Red, Yellow, Green, Blew, Purple,with their intermediate degrees ſucceeding in order from B to C. But α, according to the aforeſaid Experiment, will only yield thoſe two colors of which 'twas compounded, and thoſe not conterminate like the colors at BC,but ſeparate from one another as at β and γ, by means of the different refrangibility of the rays to which they belong. And thus by comparing theſe two whites, they would appear to be of a different conſtitution, and A to conſiſt of more colors then α. So that what Monſieur *N.* contends for, would rather advance my Theory by the acceſs of a new kind of white than conclude againſt it. But I ſee no hopes of compounding ſuch a white.

As for Monſieur *N.*his expreſſion,that I maintain my doctrine with ſome concern, I confeſs it was a little ungrateful to me to meet with objections which had been anſwered before, without having the leaſt reaſon given me why thoſe anſwers were inſufficient. The anſwers which I ſpeak of are in the Tranſactions from *pag.* 5093 to *pag.* 5102. And particularly in *pag.* 5095; to ſhew that there are other ſimple colors beſides blew and yellow, I inſtance in a ſimple or homogeneal Green, ſuch as cannot be made by mixing blew and yellow or any other colours. And there alſo I ſhew why, ſuppoſing that all colors might be produced out of two, yet it would not follow that thoſe two are the only Original colors. The reaſons I deſire you would compare with what hath been now ſaid of White. And ſo the neceſſity of all colors to produce white might have appear'd by the Experiment *pag.* 5097, where I ſay, that if any color at the *Lens* be intercepted, the whiteneſs (which is compounded of them all) will be changed into (the reſult of) the other colors.

However, ſince there ſeems to have happened ſome miſunderſtanding between us, I ſhall endeavor to explain my ſelf a little further in theſe things according to the following method.

Definitions.

1 I call that Light homogeneal, ſimilar or uniform, whoſe rays are equally refrangible.

2. And that heterogeneal, whoſe rays are unequally refrangible.

Note. There are but three affections of Light in which I have obſerved its rays to differ, *viz.* Refrangibility, Reflexibility, and Color; and thoſe rays which agree in refrangibility agree alſo in the other two, and therefore may well be defined homogeneal, eſpecially ſince men uſually call thoſe things homogeneal, which are ſo in all qualities that come under their knowledg, though in other qualities that their knowledg extends not to there may poſſibly be ſome heterogeneity.

3. Thoſe colors I call ſimple, or homogeneal, which are exhibited by homogeneal light.

4. And thoſe compound or heterogeneal, which are exhibited by heterogeneal light.

5. Different colors I call not only the more eminent ſpecies, red, yellow, green, blew, purple, but all other the minuteſt gradations; much after the ſame manner that not only the more eminent degrees in Muſick, but all the leaſt gradations are eſteemed different ſounds.

Propoſitions.

1. The Sun's light conſiſts of rays differing by indefinite degrees of Refrangibility.

2. Rays which differ in refrangibility, when parted from one another do proportionally differ in the colors which they exhibit. Theſe two Propoſitions are matter of fact.

3. There are as many ſimple or homogeneal colors as degrees of refrangibility. For, to every degree of refrangibility belongs a different color, by *Prop.* 2. And that color is ſimple by *Def.* 1. and 3.

4. Whiteneſs in all reſpects like that of the Sun's immediate light and of all the uſual objects of our ſenſes cannot be compounded of two ſimple colors alone. For ſuch a compoſition muſt be made by rays that have only two degrees of refrangibility, by *Def.* 1. and 3; and therefore it cannot be like that of the Suns light, by *Prop.* 1; Nor, for the ſame reaſon, like that of ordinary white objects.

5. Whiteneſs

5. Whiteneſs in all reſpects like that of the Sun's immediate light cannot be compounded of ſimple colors without an indefinite variety of them. For to ſuch a compoſition there are requiſite rays indued with all the indefinite degrees of refrangibility, by *Prop.* 1. And thoſe infer as many ſimple colors, by *Def.* 1. and 3. and *Prop.* 2. and 3.

To make theſe a little plainer, I have added alſo the Propoſitions that follow.

6. The rays of light do not act on one another in paſſing through the ſame Medium. This appears by ſeveral paſſages in the *Tranſactions pag.* 5097, 5098, 5100, and 5101. and is capable of further proof.

7. The rays of light ſuffer not any change of their qualities from refraction.

8. Nor afterwards from the adjacent quiet *Medium* Theſe two Propoſitions are manifeſt *de facto* in homogeneal light, whoſe color and refrangibility is not at all changeable either by refraction or by the contermination of a quiet *Medium*. And as for heterogeneal light, it is but an aggregate of ſeveral ſorts of homogeneal light, no one ſort of which ſuffers any more alteration than if it were alone, becauſe the rays act not on one another, by *Prop.* 6. And therefore the aggregate can ſuffer none. Theſe two *Propoſitions* alſo might be further proved apart by Experiments, too long to be here deſcribed.

9. There can no homogeneal colors be educed out of light by refraction which were not commixt in it before: Becauſe, by *Prop.* 7, and 8, Refraction changeth not the qualities of the rays, but only ſeparates thoſe which have divers qualities, by meanes of their different Refrangibility.

10. The Sun's light is an aggregate of an indefinite variety of homogeneal colors; by *Prop.* 1, 3, and 9. And hence it is, that I call homogeneal colors alſo primitive or original. And thus much concerning Colors.

Monſieur *N.* has thought fit to inſinuate, that the aberration of rays (by their different refrangibility) is not ſo conſiderable a diſadvantage in glaſſes as I ſeemed to be willing to make men believe, when I propounded concave mirrors as the only hopes of perfecting Teleſcopes. But if he pleaſe to take his pen and compute the errors of a Glaſs and Speculum that collect rays at equal diſtances, he will find how much he is miſtaken, and that I have not been extravagant, as he imagins, in preferring Reflexions. And as for what he ſays of the difficulty of the praxis, I know it is very difficult, and by thoſe ways which he attempted it I believe it unpracticable. But there is a way inſinuated in the *Tranſactions pag.* 3080. by which it is not improbable but that as much may be done in large Teleſcopes, as I have thereby done in ſhort ones, but yet not without more then ordinary diligence and curioſity.

A Relation from Dantzick, *about an odd effect of Thunder and Lightning upon Wheat and Rye in the Granaries of that City; communicated in a Letter of* June 24. 1673. *by M.* Chriſt. Kirkby.

SIR,

YOU doubtleſs know, how much this City is famed for its numerous and convenient Granaries, it being the Repoſitory of all ſorts of grain, the fruitful Kingdom of *Poland* affords. In thoſe Granaries are laid up chiefly Wheat and Rye in parcels, of 20, to 30 and 60 Laſts in one chamber, according to its largeneſs, and the dryneſs of the Corn; which they turn over 3, 4, 5, 6 times a week, as need requires to keep it ſweet, and fit for ſhipping. Now it hapned, that about the latter end of *March* and *April* laſt we had much and violent Thunder and Lightning, which had this unhappy effect upon all the parcels of Wheat and Rye of the laſt years growth, that, though over-night they were dry, ſweet, and fit for ſhipping, the next morning they had loſt all theſe good qualities, and were become clammy and ſtinking, and conſequently unfit to be ſhip't away for the preſent: So that the Owners, if they would not looſe their grain, were forced to cauſe it to be turn'd over two or three times a day, and yet it required ſix weeks, if not longer, before it was recover'd.

This is a thing, which often happens to Corn that hath not lain in the Granary a whole year, or not ſwet thoroughly in the ſtraw before it be thraſh'd out. An accident little noted, yet in my judgment worth the inquiring into. For, though the Alterations, cauſed by Thunder in *Liquors*, be taken notice of, and probable reaſons given for them; yet I judge this ſomewhat more abſtruſe, and therefore more worth while to be conſider'd.

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